

COASTAL SCENIC EVALUATION SYSTEM (CSES) USER'S MANUAL

**Code Version: V1-2018
Manual Version: 1.0**

<http://cses.ce.metu.edu.tr>



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Foreword

Coastal areas are under threat due to the conflicting requirements that rely on natural scenery of such as habitation, recreation, and industry. The coastal scenery is a natural source as a part of a coastal landscape inventory. Therefore, it has to be evaluated in an objective and quantitative way to provide a basis to be used as a scientific tool in coastal zone management and development.

In views of these objectives, British Council Project ‘Coastal Scenic Assessment at Selected Areas: Turkey, UK’ was carried out between the years 2001-2004, as the first pilot project of its type for trans-national boundaries.

An evidence-based methodology called ‘Coastal Scenic Evaluation System (CSES)’ is developed aimed to assess the dominance of natural scenery and their attendant subsections in an objective and quantitative way comprehensively. CSES is based on 18 physical and 8 human parameters (such as unattractive urbanization, intensive development) established on five scale attribute rating system. With regards to national and cultural differences in natural scenery appreciation and preferences an expert evaluation process was carried out via public survey questionnaires for Turkey, UK, Malta and Croatia and with coastal experts from Australia, Ireland, USA and Japan.

CSES provides a mathematical model based on fuzzy logic to integrate the parameters’ weights into an expert-rating system of scenic sites. The quantitative evaluation of the coastal scenery by using fuzzy logic mathematics is proved to be appropriate to reduce subjectivity on decision-making the phase of the assessment. The fuzzy logic analysis gives an overall result for scenic evaluation over attributes enabling calculation of a coastal scenic evaluation index (D) which categorizes all sites into five classes via statistically best-described attribute values regarding weighted areas.

By the authors of this book, over a span of a decade or so at least 952 global coastal sites were assessed by CSES. Therefore, in the last phase of our studies we, a group of academicians namely Allan T. Williams, Nelson Guillermo Rangel-Buitrago, Giorgio Anfuso, Anton Micallef and Enzo Pranzini worked hard together on our book

'Coastal Scenery: Evaluation and Management' to be published by Springer.

Coastal scenic evaluation system (CSES) is re-implemented in MATLAB environment in Ergin et al. (2018). The developed code "CSESV1-2018" is presented as an open-source computational tool for the coastal scenic evaluation system with User's Manual and with an example case study.

We hope that the book will provide a scientific basis to evaluate coastal scenery in an objective and quantitative way by introducing CSES to be used for coastal landscape preservation and protection as an innovative methodology for any envisaged coastal management and future developments.

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Coastal Scenic Evaluation System (CSES) User's manual

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Coastal Scenic Evaluation System (CSES) is an evidence-based novel approach that can be used for landscape preservation, and to provide baseline information as a scientific tool for envisaged coastal management and future development plans. CSES uses fuzzy logic for the quantitative evaluation of coastal scenery based on the results of the public surveys.

CSES has been developed in the last fifteen years mainly by Ergin et al. (2002, 2004, 2006, 2011). Recently, CSES has been summarized including the background mathematics, algorithms and example case studies in the book “Coastal Scenery: Evaluation and Management” in Chapter 4 (Ergin, 2018). Based on the extensive discussions given in Ergin (2018), a MATLAB® code called CSES-V1-2018 has firstly released as a generic open-source tool for application of CSES (Ergin et al., 2018). CSES-V1-2018 can be used with the same physical and human parameters given in Ergin (2018). On the other hand, it is allowed to change all the physical and human parameters. The only restriction is to keep rating system (1 to 5).

The present User's Manual is written for the version V1-2018 of the code. The version number would be updated as the code is being updated. Please refer to Ergin (2018) for the basis of the methodology and Ergin et al. (2018) for the open-source implementation of the code. The code is available under BSD License. (See Section 6 or “license.txt” in “/source” folder for details).

In the present manual, the inputs and outputs of the code are described assuming the user has some working experience with

MATLAB®. Furthermore, an example from Ergin (2018) for Çıralı, Karaburun, Turkey is given as while describing inputs and outputs of the code. Sample inputs and outputs for this example are also given in the folders “/sample-inputs” and “/sample-outputs”, respectively.

1 Code Inputs

There are two groups of inputs for CSES-V1-2018. The first group is “Direct Inputs from mainCSES.m” and the second group is “Inputs Prepared as Separate Text Files”. Furthermore, it is possible to change the definition/formulation of the “Decision Parameter (D)” that is calculated at the end of this scenery evaluation methodology via the function “computeD.m”. In this section, inputs and “computeD.m” are described.

1.2 Direct Inputs from mainCSES.m

Direct inputs from mainCSES.m and their explanations are given in Table 1.

Table 1 Explanations of Direct Inputs from mainCSES.m

Input	Explanation
numOfSurveys	Number of surveys conducted. This variable must be an integer.
siteName	Name of the studied site. Type of this variable is string. The site name must be written in single quotation mark such as ‘name.’
physicalName	Name of the text file that contains information about physical parameters that are used in CSES. The extension of the filename should also be included such as “.txt”. Type of this variable is string.
humanName	Name of the text file that contains information about human parameters that are used in CSES. The extension of the

	filename should also be included such as “.txt”. Type of this variable is string.
memGradName	Name of the text file that contains information about membership grading matrices that are used in CSES. The extension of the filename should also be included such as “.txt”. Type of this variable is string.
WfPhys	The weight of subset physical parameters. Type of this variable is double. Summation of subsets WfPhys and WfHum must be equal to 1. The default value of this variable is recommended as 0.5.
WfHum	The weight of subset human parameters. Type of this variable is double. Summation of subsets WfPhys and WfHum must be equal to 1. The default value of this variable is recommended as 0.5.
compD	If the definition of Decision Parameter (D) is kept as original, this variable must be equal to 1. On the other hand, if one change definition of Decision Parameter via modifying “computeD.m”, this parameter can take any other value than 1.
figuresOn	A switch for plotting figures. If this variable equals to 1, the code plots the output figures. On the other hand, if this variable equals to 0, the code does not plot the output figures. This variable must be 0 or 1.
printFigures	A switch for printing figures. If this variable equals to 1, the code prints the output figures. On the other hand, if this variable equals to 0, the code does not print the output figures. This variable must be 0 or 1. Please note that figures must be plotted first to print them out.
printOut	A switch for writing “csesResults.txt” that includes results of the analysis. If this

	variable equals to 1, the code writes the results file. On the other hand, if this variable equals to 0, the code does not write the results file. This variable must be 0 or 1.
fontName	Name of the font that will be used in all output figures. Default input should be 'Calibri'. Type of this variable is string.
fontSizeFig1	The font size that will be used in output Figure 1. Default input should be 16. This variable must be an integer.
fontSizeFig2	The font size that will be used in output Figure 2. Default input should be 16. This variable must be an integer.
fontSizeFig3	The font size that will be used in output Figure 3. Default input should be 16. This variable must be an integer.
memGradName	Name of the text file that contains information about membership grading matrices that are used in CSES. The extension of the filename should also be included such as ".txt". Type of this variable is string.

Sample values of these direct inputs can be seen in the following list for Çıralı, Karaburun, Turkey in Ergin (2018).

```

numOfSurveys=485;
siteName='Ciralı, Karaburun';
physicalName='physicalParameters.txt';
humanName='humanParameters.txt';
memGradName='membershipGradingMatrices.txt';
WfPhys=0.5;
WfHum=0.5;
figuresOn=1;
printFigures=1;
printOut=1;
fontName='Calibri';
fontSizeFig1=16;

```

```
fontSizeFig2=16;  
fontSizeFig3=16;
```

1.3 Inputs Prepared as Separate Text Files

1.3.1 Physical and Human Parameters

Information about physical and human parameters have to be prepared as a text file. Note that name of these text files should be specified via “Direct Inputs from mainCSES.m” (See Section Direct Inputs from mainCSES.m).

In both text files, each line should contain information about a single parameter. In each line, the name of the parameter, weight of the parameter, number of total scores ticked for attribute 4 (Ni,4), number of total scores ticked for attribute 5 (Ni,5) and graded attributes of the site should be written. Note that other than the type of “the name of the parameter” which is string, type of all other variables should be integers.

The weight of the parameters is inputted as the denominator of the ratio. For example, if the weight of the parameter is $1/36$, one should enter the value as 36.

Sample inputs for physical and human parameters are given in the following list, respectively, for Çıralı, Karaburun, Turkey that is given in Ergin (2018, see Table 4.6. in Chapter 4 of the book)

Sample Inputs for Physical Parameters

```
Cliff Height,36,114,77,3  
Cliff Slope,36,82,65,5  
Cliff Special Features,36,99,137,3  
Beach Type,36,101,229,4  
Beach Width,36,143,146,4  
Beach Color,36,119,111,4  
Rocky Shore Slope,36,86,45,1  
Rocky Shore Extent,36,89,57,1  
Rocky Shore Roughness,36,102,108,1  
Dunes,12,86,66,2
```


Valley,12,146,128,4
Skyline and Landform,12,106,172,5
Tides,12,64,64,5
Coastal Landscape Features,12,120,288,3
Vistas,12,142,171,4
Water Color and Clarity,12,73,387,5
Natural Vegetation Cover,12,136,239,5
Vegetation Debris,12,86,165,5

Sample Inputs for Human Parameters

Noise and Disturbance,8,116,315,5
Litter,8,38,419,4
Sewage,8,38,419,5
Non-built Env.,8,108,104,5
Built Env.,8,109,315,4
Access Type,8,106,205,4
Skyline,8,109,315,5
Utilities,8,109,315,5

1.3.2 Membership Grading Matrices

Membership grading matrices are also inputted as a text file. Note that name of these text files should be specified via “Direct Inputs from mainCSES.m” (See Section 4.1 and the Appendix 2 belongs to chapter 4, Ergin 2018).

In this text file, one should write membership matrices one under the other. Since the rating system is out of five, each membership matrix is 5 by 5. Therefore, the text file is a (5*n) by 5 matrix where “n” is the total number of physical and human parameters. In this text file, one should first write the membership matrices for physical parameters first and should continue with membership matrices for human parameters. The order of the parameters should be same with the files given in the **Sample Inputs for Physical Parameters** section.

It might be confusing to write all the matrices in the correct order in a text file. Therefore, the authors have prepared an MS Excel file to ease this process for the example study. You may see the MS Excel file in “/sample-inputs” folder which is called “membershipGradingMatrices.xlsx”. This example is given for 26 parameters for the example site Çıralı, Karaburun, Turkey (Ergin, 2018).

1.3.3 Modifying the Decision Parameter: How to change “computeD.m”

There is a certain definition for “Decision Parameter” given by Ergin (2018) based on the previous studies. However, CSES-V1-2018 is a generic code, one might would like to change the definition of Decision Parameter (D). To do that, the code called “computeD.m” should be modified.

“computeD.m”, a user-defined function, originally returns the values of D1, D2, D3 and D4 parameters defined by Ergin (2018) using the areas under membership degrees vs. attributes curve. Definition of D (at the final line before “end” statement) could be changed directly from this code.

2 Code Outputs

CSES-V1-2018 gives three groups of outputs upon the request of the user. The first group is messages to screen, the second group is output figures (controlled by the variable figuresOn, see Section 2.1), and the third group is results file called “csesResults.txt” (controlled by the variable printOut, see **Section Inputs of the Code**).

2.1 Direct Messages to Screen

Results of “Decision Parameter” calculations are directly printed out to screen (Command Window of MATLAB®) whenever printOut=1. In this message, D values are summarized, and the classification of the site being studied is given. The message for the example site

Çıralı, Karaburun, Turkey (Ergin, 2018) is presented in the following list.

D values can be summarized as follows:

D1=0.87 D2=6.45 D3=0.73 D4=D=1.26

According to classification by Ergin (2018):

This site is Class I ($D \geq 0.85$) meaning that:

Top natural: extremely attractive sites with very high landscape value

2.2 Results File

The results of the computations are written as a text file called “csesResults.txt” whenever `printOut=1`. In this file computed weights of physical and human parameters are presented with graded attributes in addition to weighted averages for subset physical parameters (Vp), weighted averages for subset human parameters (Vh) and final assessment matrix (R) representing membership degrees.

Sample results file for Çıralı, Karaburun, Turkey (Ergin, 2018) is given in the following list:

Physical Parameters: Weights of Parameters,
Graded Attributes

Cliff Height:	0.019	3
Cliff Slope:	0.014	5
Cliff Special Features:	0.024	3
Beach Type:	0.034	4
Beach Width:	0.029	4
Beach Color:	0.023	4
Rocky Shore Slope:	0.013	1
Rocky Shore Extent:	0.014	1
Rocky Shore Roughness:	0.021	1
Dunes:	0.045	2
Valley:	0.081	4
Skyline and Landform:	0.085	5

Tides:	0.038	5
Coastal Landscape Features:	0.127	3
Vistas:	0.094	4
Water Color and Clarity:	0.147	5
Natural Vegetation Cover:	0.115	5
Vegetation Debris:	0.077	5

Human Parameters: Weights of Parameters,
Graded Attributes

Noise and Disturbance:	0.136	5
Litter:	0.150	4
Sewage:	0.150	5
Non-built Env.:	0.064	5
Built Env.:	0.134	4
Access Type:	0.097	4
Skyline:	0.134	5
Utilities:	0.134	5

Weighted Averages for Subset Physical
Parameters, Vp

0.048	0.050	0.189	0.391	0.531
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Weighted Averages for Subset Human Parameters,
Vh

0.000	0.019	0.113	0.435	0.668
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Final Assessment Matrix (R) - Membership
Degrees

0.024	0.035	0.151	0.413	0.600
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2.3 Output Figures

Three output figures are plotted whenever figuresOn=1. These figures could be printed with the names fig1.jpeg, fig2.jpeg and

fig3.jpeg for the Figures 1-3, respectively, whenever figuresOn=1 and figuresOn=1. The first figure is “Scenic Assessment Histogram” presenting all the physical and human parameters versus their ratings. The second figures are “Weighted Averages vs. Attributes”. The final one is “Membership Degrees vs. Attributes”. Note that region name, the font size of each figure and the font name of all the figures can be controlled using the parameters described in Section Direct Inputs from mainCSES.m

Figures that are plotted and printed for the example site Çıralı, Karaburun, Turkey are given in Fig.1, Fig. 2 and Fig. 3, respectively.

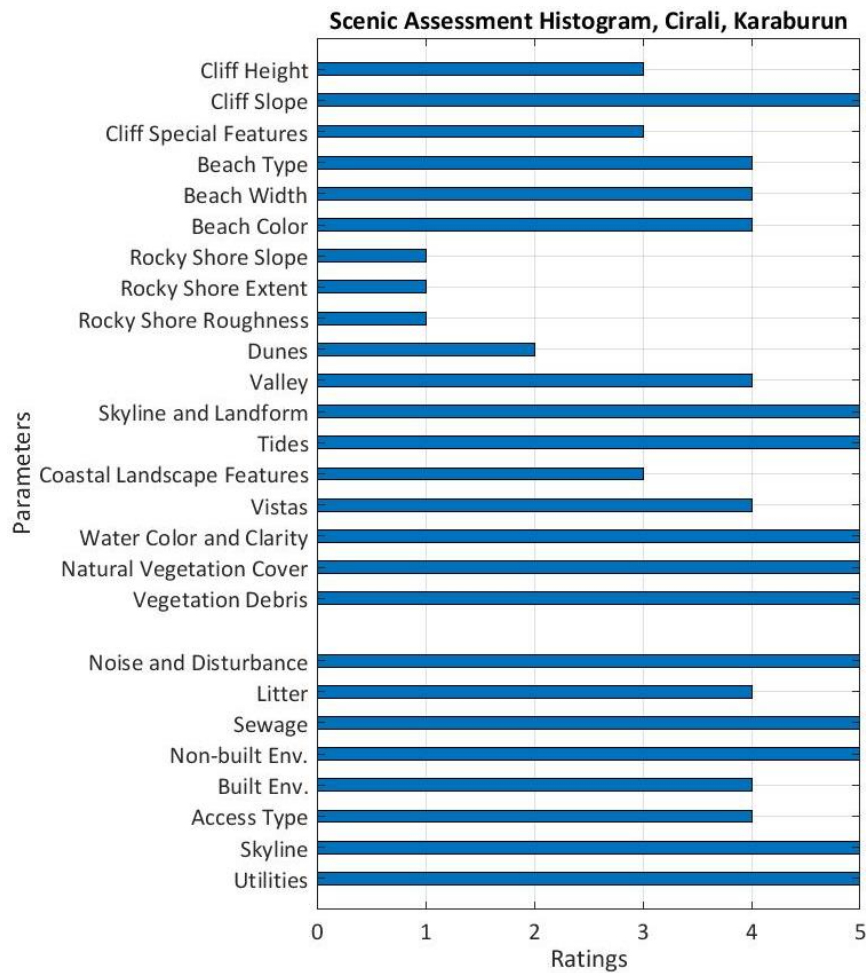


Fig. 1. Scenic Assessment Histogram, Çıralı, Karaburun, Turkey (Ergin, 2018).

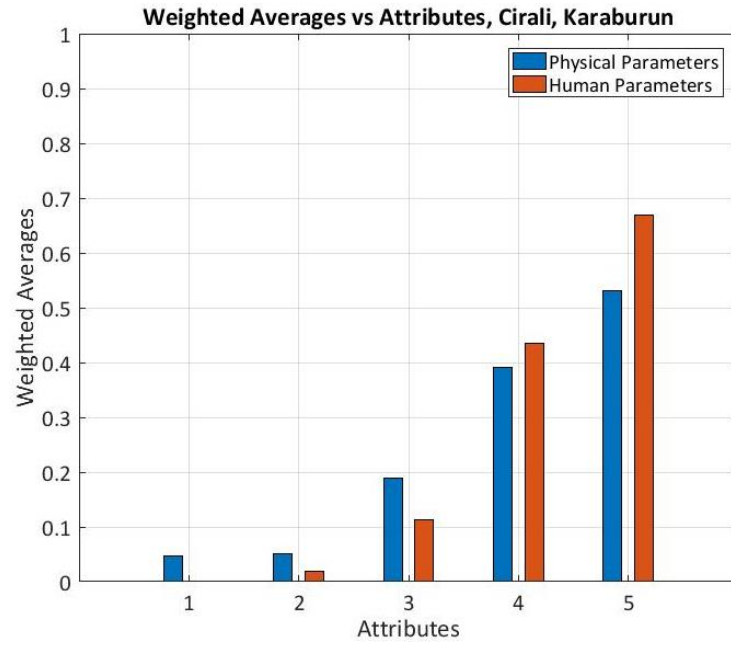


Fig. 2. Weighted Averages vs Attributes, Çıralı, Karaburun, Turkey (Ergin, 2018).

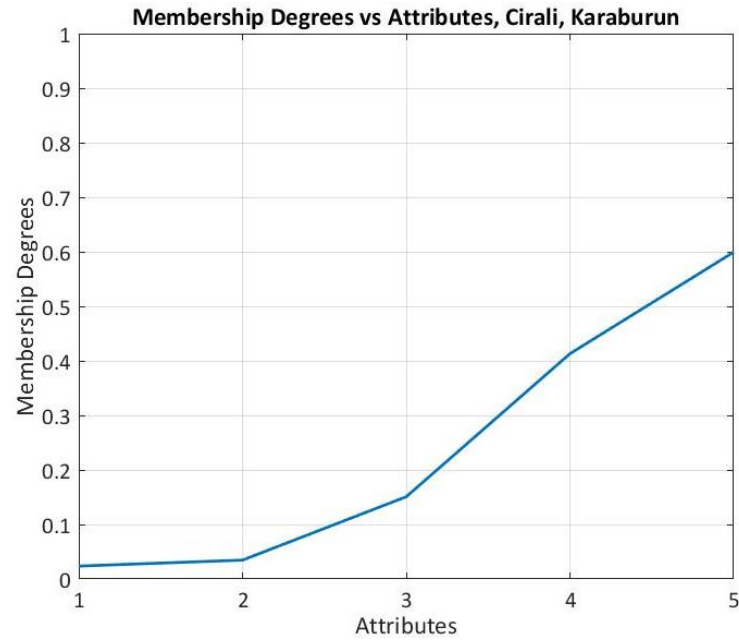


Fig. 3. Membership Degrees vs. Attributes, Çıralı, Karaburun, Turkey (Ergin, 2018).

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